

CASE STUDY REPORT #10
ROCK CREEK DIVERSION DAM
NORTH FORK FEATHER RIVER

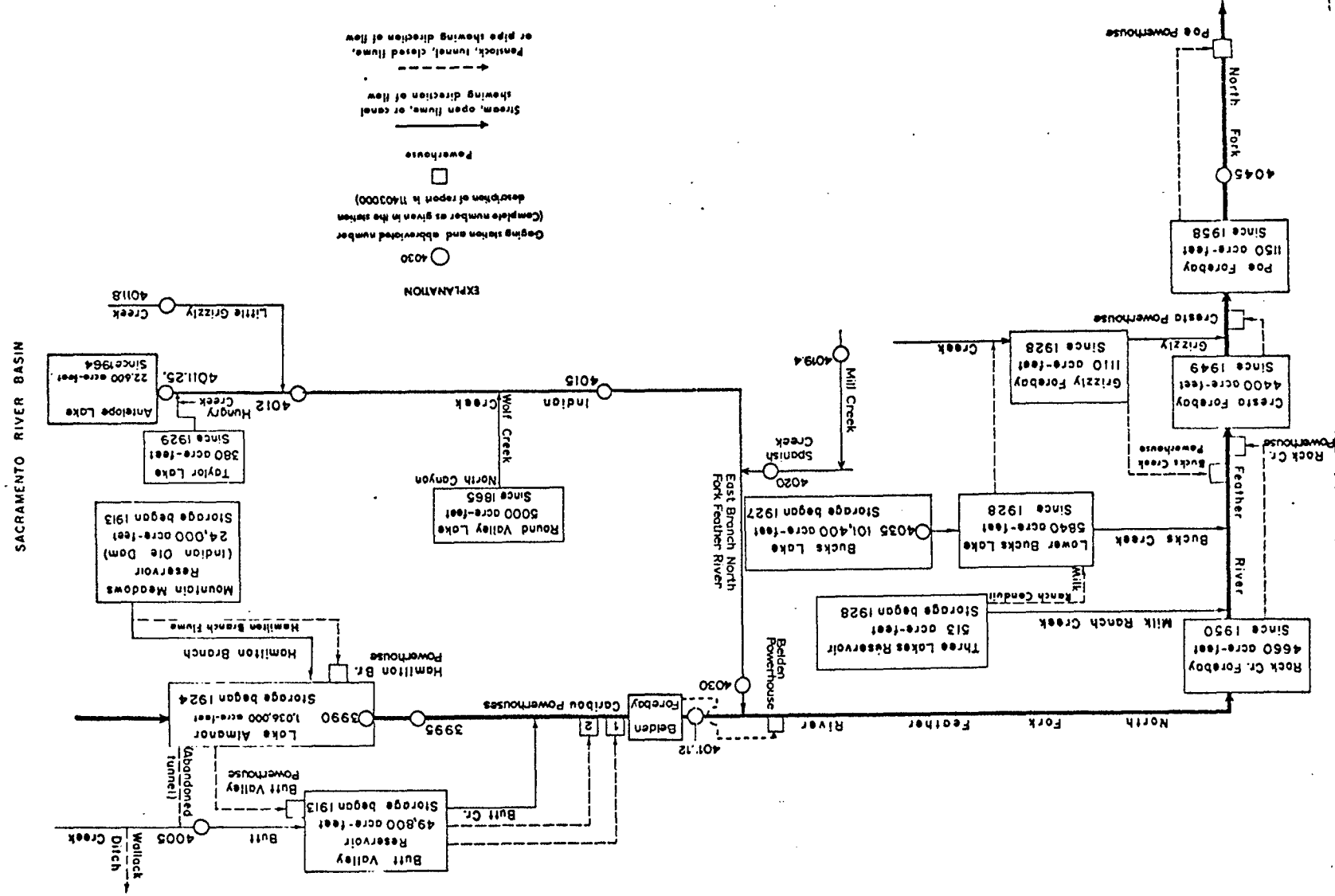
I. Project Description

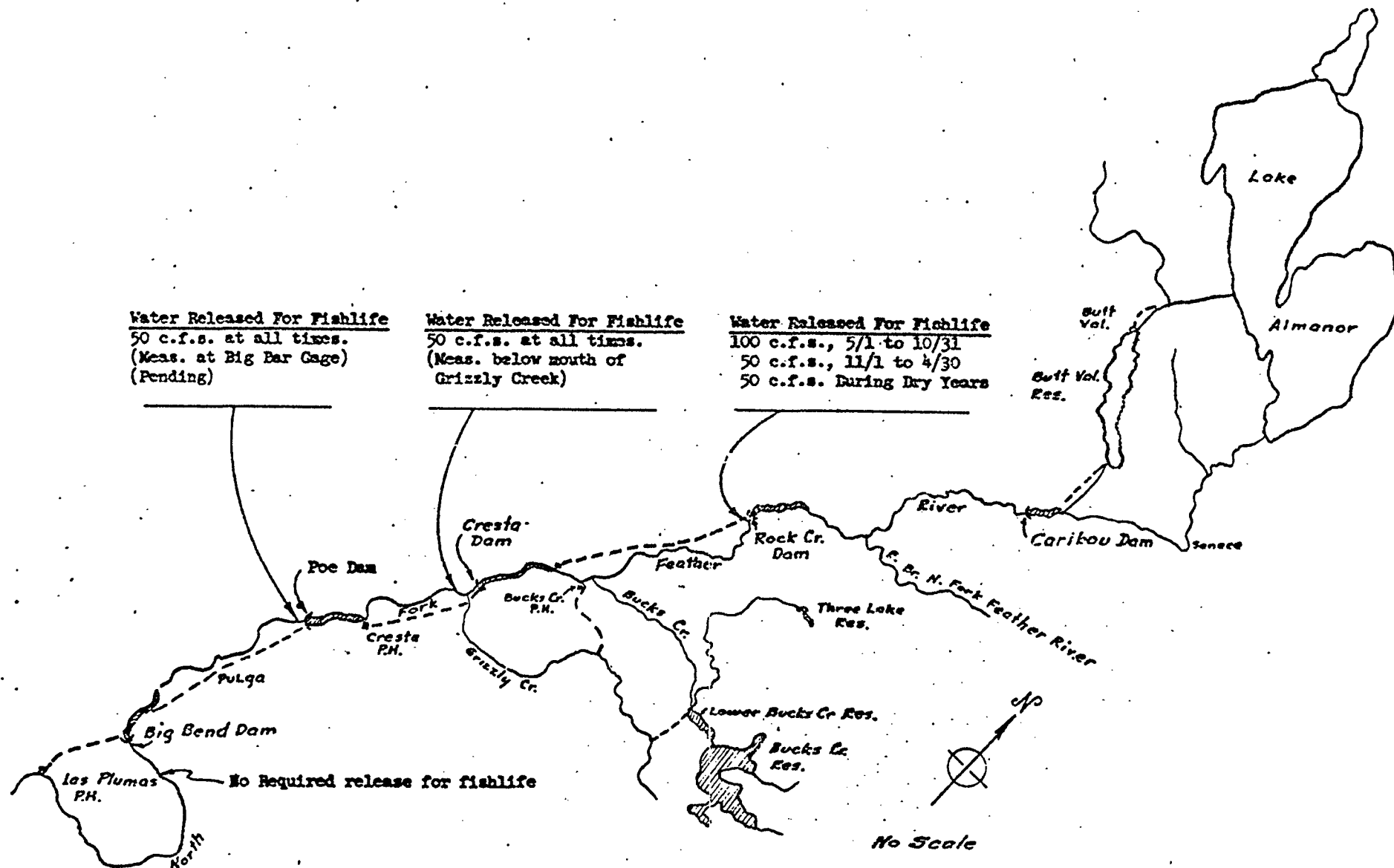
Rock Creek Diversion Dam in the North Fork Feather River is a major component of Pacific Gas & Electric Company's (PG&E) Rock Creek-Cresta Hydroelectric Power project. These two diversion dams and other existing impoundments on the North Fork of the Feature River are controlled to maximize hydroelectric power production. This case study is concerned with the Rock Creek Dam which was completed in 1950 and the downstream 8-mile reach of the river. The entire project was licensed by the Federal Power Commission (License #1962) in 1947). At maximum pool the reservoir provides storage of 5,200 acre-feet with 135 surface acres. A tunnel and a conduit convey diverted river water to a powerhouse located approximately 7.5 miles downstream from the dam structure. The schematic layout of the Rock Creek-Cresta project in relation to other hydroelectric structures in the North Fork Feather River basin is shown in Figure 1. The complexity of basin development can be interpreted from Figures 1 and 2.

Figure 1
LOCATION MAP

Source: U. S. Geological Survey, 1973, water resources data for California.

--Schematic diagram showing diversions and storage in North Fork Feather River basin.





Existing Hydroelectric Development on the North Fork Feather River.

Figure 2

Adapted from: California Department of Fish and Game, 1961, "Effects on Fish and Wildlife Resources of Proposed Water Development on Middle Fork Feather River".

II. Pre-Project Description

Prior to 1950 the North Fork Feather River downstream from the Rock Creek Dam site was a large, fast-flowing stream containing a trophy rainbow trout fishery. When Rock Creek Powerhouse was completed, minimum flows were reduced from an average of 1,500 cfs to 100 cfs or less in dry years. In 1946, and in response to the proposed Rock Creek-Cresta project, the Department of Fish and Game conducted a study and estimated 36,000 angler days were used to catch 108,000 trout in the affected part of the river. Estimates made by the Department of Fish and Game placed the value of the fishery resource in the North Fork Feather River at about \$360,000 annually. Before 1950, rainbow and brown trout were the principal species of fish in the North Fork Feather River, although smallmouth bass and chinook salmon were taken in sections below the project area.

River flow above Rock Creek Dam has been influenced by the Lake Almanor Dam since July 1913 and the Butt Valley Reservoir Dam since May 1927. Stream flow releases from Lake Almanor, approximately 20 miles upstream from Rock Creek Dam, have been erratic. According to 1943 flow release records, the mean discharge from Lake Almanor was 283 cfs. However, releases of less than 20 cfs were made during the months of May, June, July, August and September with a minimum release of 4.4 second-feet being made in September. A pre-project flow hydrograph was not obtainable.

III. Project Development

In 1947 the U. S. Fish and Wildlife Service and the Department of Fish and Game began investigations to determine flow requirements for the maintenance of fish and wildlife resources in the North Fork Feather River from Lake Almanor to below Cresta Dam. A primary objective was to develop environmental descriptions from which the USFWS and the Department of Fish and Game could make determinations of minimum stream flow requirements. Thereafter, recommendations would be made to the licensing agencies (Federal Power Commission and State Water Rights Board).

Pre-project investigations on the North Fork Feather River were concerned with elements of the stream flow regime: 1) evaluation of historic flow records; 2) determine the type, quantity, quality, economics, and any special requirements of the stream fishery; 3) associated projects including Butt Valley Reservoir, Lake Almanor and the Caribou powerhouse; and 4) the wildlife requirements associated with stream flow maintenance. The information developed in these investigations (which were not obtained for this study) was examined by USFWS and Department of Fish and Game and recommendations were made for the minimum in-stream flow release needed to maintain a viable trout fishery.

Stemming from the recommendations, in-stream flow agreements between the USFWS, U. S. Forest Service, Department of Fish and Game and PG&E were achieved through a series of negotiations. The initial appraisal including minimum stream flow recommendations was a joint effort of the USFWS and the Department of Fish and Game and was released as a memorandum report early in 1948.

This 1948 memorandum report recommended minimum in-stream flow releases of 217 cfs from Rock Creek to Bucks Creek Powerhouse. These recommendations were revised approximately one month later to read as follows:

- "a. Minimum flows be maintained at all times in sections of North Fork as follows:
 - "i. Not less than 200 second-feet in the 7.5-mile section from Rock Creek Dam to the head of Cresta forebay to be measured at the point of release from the dam.
- "b. A minimum flow of not less than 200 second-feet be established as a part of any license that may be granted to the Pacific Gas and Electric Company for construction of any project on the main stem of North Fork of Feather River.
- "c. Rock Creek and Cresta Dams be constructed with outlet facilities located as low as possible to assure the release of cool water for fish life.
- "d. Further study be given the possibility of constructing an afterbay dam to smooth flow irregularities occasioned by the operation of Caribou power plant on North Fork.
- "e. The license for the project, if granted, be held open with respect to the problem of screening the intakes of diversions from Rock Creek and Cresta Dams. The justification for screens cannot be adequately determined until the project is in operation.

- "f. The entire project area be open to free public access for fishing and other recreational uses, except such portions as may be reserved by the Pacific Gas and Electric Company in the interest of safety, efficient operation, and protection of property."

In June of 1949 these flow recommendations were again revised in a USFWS letter to the Chairman of the Federal Power Commission, and the revised recommendations replaced the previous minimum flow agreement reads as follows:

- "a. Minimum flows be maintained at all times in sections of the North Fork Feather River as follows:
- "ii. Not less than 100 second-feet during the summer period and 60 second-feet during the winter period, as measured immediately below Rock Creek diversion dam, except that during dry years, criteria of which shall be previously determined by a cooperative agreement between the licensee, the California State Division of Water Resources, the California Division of Fish and Game and the FWS, the summer flow may be reduced to not less than 50 second-feet.

In section ii above, the 60 second-feet was an error and should read 50 second-feet.

After several meetings with the project sponsor, PG&E, to negotiate an in-stream flow release agreement, the following stipulations were agreed to by the USFWS, Department of Fish and Game, U. S. Forest Service and PG&E and was included as Article 13 of the Federal Power Commission License No. 1962 as amended February 15, 1950.

Article 13 (as amended, February 15, 1950)

"For the protection and support of fish life and the recreational resources of the North Fork of Feather River:

"a. The Licensee shall provide:

"ii. Immediately below Rock Creek Diversion Dam: a flow of not less than 100 cfs from May 1 to October 31, which flow may be reduced to not less than 50 cfs in dry years; and a flow of not less than 50 cfs from November 1 to April 30.

"b. The Licensee shall design its structures for the release of the flows, provided in "a" above, so that the water will be taken from as near to the bottom of the reservoir as is practicable, and suitable criteria for the determination of dry years for the purpose of fixing the May 1 to October 31 water releases provided in "a" above shall be established by the Commission.

"c. The Commission reserves the right to adjust said rates of flow in items a(ii) and a(iii), above, if it shall find, after notice to interested parties and opportunity to be heard, that the rates of flow are more than necessary or insufficient for such purposes.

"d. The Licensee shall provide electric fish screens at the intakes to the diversion tunnels for the Rock Creek and Cresta projects if such be found by the Commission to be justifiable.

"e. The Licensee shall advance the sum of \$40,000 toward the construction of two "rough" fish barriers on North Fork of Feather River if such are later found to be necessary: one to be located above the mouth of Yellow Creek and the other between Bucks Creek and the upper end of Cresta Diversion Reservoir. The necessity for either or both of these barriers shall be determined during the first ten years following the commencement of operation of Cresta project.

- "f. The entire project area shall be open to free public access for fishing and other recreational uses, except such portions as may be reserved by the Licensee in the interest of safety, efficient operation, and protection of property."

IV. Post-Project

A post-project evaluation of the in-stream flow release agreement, as amended February 15, 1950, was conducted by the USFWS in 1962 (Initial Follow-Up Report for Rock Creek-Cresta, FPC No. 1962 North Fork Feather River, California). This evaluation was to determine the acceptability, fulfillment and effectiveness of pre-project recommendations for the protection of fish and wildlife. The report indicated that trout angling was excellent in the North Fork Feather River downstream of Lake Almanor Reservoir to the Caribou Powerhouse. However, below Belden (see Figure 2), the pre-project fishery resources of the North Fork Feather River had nearly been destroyed. This loss was attributed to reduced flows and associated proliferation of non-game fish which are now favored at the expense of the trout population.

Principal fish species inhabiting both the river and reservoirs in this section were sucker, hardhead, squawfish, carp and sculpin. The Rock Creek and Cresta Reservoirs served as nurseries for the non-game fishes which have largely displaced trout in the river. Rough fish proliferated in the long, quiet pools and newly created forebays. By 1955, angling had become mediocre despite large plants of catchable trout. A

creel census that year revealed angling success for the season averaged only 0.23 trout per hour. In 1961, the Department of Fish and Game opened the North Fork of the Feather River from Belden downstream to Lake Oroville for underwater spear fishing of carp, hardhead, squawfish and sucker, in an attempt to provide some degree of recreational fishery.

The non-game species populations became so large that the Department of Fish and Game found it necessary to attempt non-game fish control in this once very popular fishing area. The following is a Department of Fish and Game review of post-project conditions.

"In 1966 when the section was chemically treated, the trout biomass was only 3 pounds/acre while rough fish totaled 522 pounds/acre. Following chemical treatment the stream was replanted with 19,000 brown trout fingerlings, 2,500 brown trout subcatchables (8 inches average) and 7,000 marked rainbow fingerlings. Creel checks in 1967 revealed that angling success improved considerably averaging 1.0 trout per hour.

"The stream was chemically treated again during the fall of 1967. Analysis of data collected from study sections established in 1966, indicated that the trout biomass had increased from 3 pounds/acre to 20 pounds/acre within a year; a six-fold increase. Even if we exclude the planted trout which accounted for half of the biomass, enough wild rainbow trout drifted into the treated section to produce a biomass of 10 pounds of trout per acre.

"The carrying capacity of the river for wild rainbow production appears to be considerably greater and perhaps could be improved for a few years prior to rough fish repopulation. For example, in 1970, a trout population of 60 pounds/acre was recorded in a section of the North Fork Feather River below Almanor Dam containing few rough fish. On the other hand, only 30 pounds of trout/acre was recorded in river sections at Seneca and Caribou where rough fish numbers exceeded 200 pounds/acre.

"None of the rainbow trout from the marked fingerling plants were observed during the 1967 treatment. On the other hand, an estimated 7 percent of the brown trout fingerlings survived and reached an average length of nine inches within a year. Rough fish, though not completely eradicated, totaled 11 pounds/acre one year following the 1966 treatment, a dramatic reduction from the 522 pounds/acre recorded during the 1966 treatment. In 1966 the rough fish biomass consisted of 93 percent suckers. In 1967 the biomass of suckers declined to 25 percent, sculpins nearly disappeared and the percentage of hardheads and squawfish increased substantially. The tremendous sucker population prior to 1966 may have inhibited production of hardheads and squawfish as well as trout.

"No fish were planted in the river following the 1967 treatment. Despite this, angling was good in 1968 and 1969. For example, 52 anglers checked in August of 1969 (a poor fishing month) fished 80 hours and creeled 55 trout, a catch per hour of 0.7 fish. The fish caught were wild rainbow trout which had drifted down from untreated tributaries."

The North Fork Feather River fishery was sampled again during 1972 to 1974. The results indicated a loss production in the trout fishery for the same reasons that were previously discussed. The present fishery is composed of large numbers of squawfish, hardhead, carp and suckers.

The calibrated staff gauge below Rock Creek is read only occasionally. Figure 3 illustrates the results of this monitoring of in-stream flow and notes that the flow is often less than the agreed amount.

V. Conclusion

The operation of Rock Creek Diversion Dam and the associated tunnel and conduit system drastically altered stream-flows in the North Fork of the Feather River. Several follow-

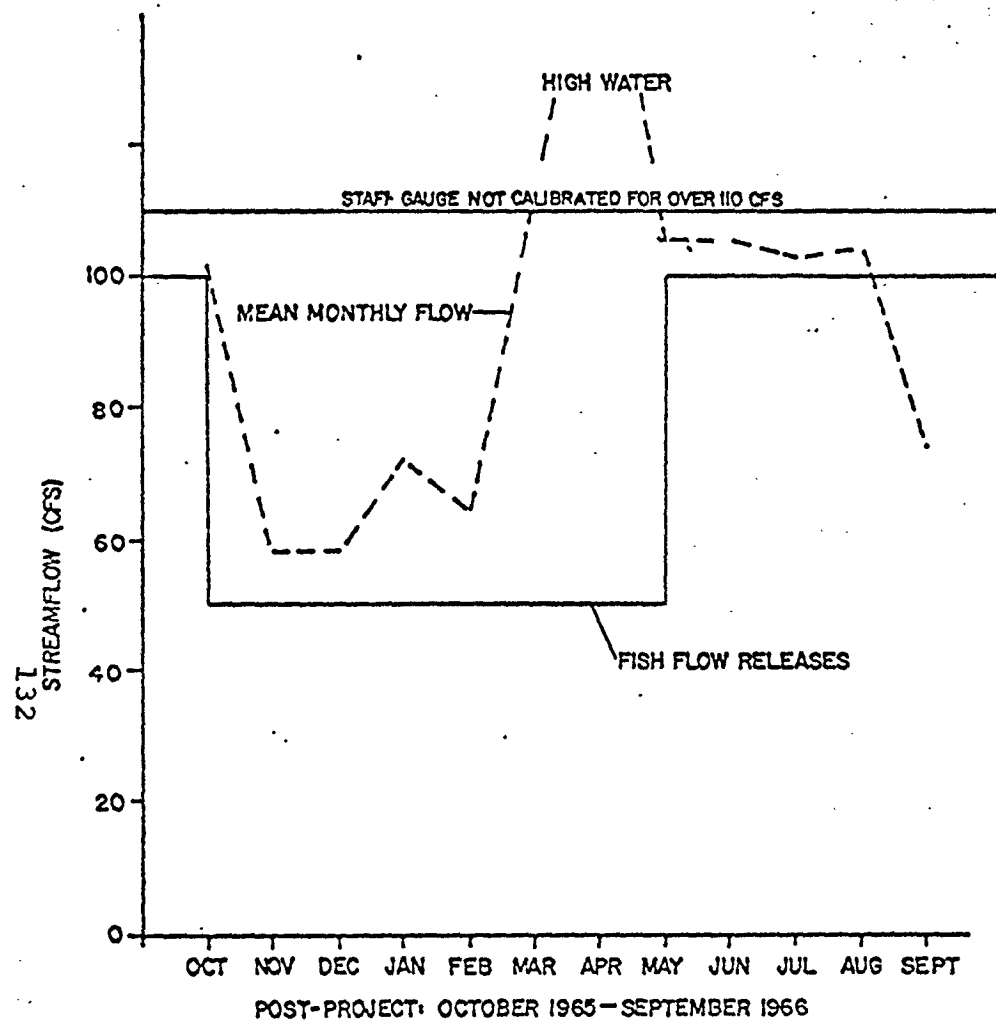
up investigations indicate that the required flows allocated for fish and wildlife preservation are generally maintained, although flows are often less than 100 cfs (see Figure 3).

The trout fishery supported by pre-project streamflows was severely impaired because the habitat created by the altered streamflow is more suitable for non-game species which are in direct competition with trout. Two stream improvement projects (non-game species eradication and restocking with trout) in the early 1960's restored the fishery for relatively short periods of time. Less than two years after each improvement, the fishery again rapidly deteriorated.

From the available information, there was no evidence that a quantitative study was conducted to determine the instream flow requirements below Rock Creek Dam. Instream flow requests were based primarily upon the historic low summer flow data and project economics. It seems apparent that the recommendations were not very strong in view of the pre-project minimum flow of about 1,500 cfs. Initial flows requested were 200 second-feet at all times and this was negotiated to the 100 second-feet summer and 50 second-feet winter flows.

In consideration of the effects the Rock Creek project had upon the fishery, the methods used to preserve fish and wildlife resources are ineffective.

The 1962 USFWS follow-up report recommended that a study of the North Fork Feather River should be made by Department



Preliminary stream flow data, taken occasionally at USGS Station No. 11403200 below Rock Creek Dam, was reviewed for the water years 1966 to 1973. During that period, 42 recordings were below the minimum in-stream flow release requirements.

FIGURE 3
STREAMFLOW CONDITIONS, NORTH FORK OF
THE FEATHER RIVER
ROCK CREEK DIVERSION DAM

of Fish and Game to determine what flows and/or other means would be necessary to provide suitable habitat for trout. They recommended seven major subject areas for considerations:

- "1. Study of water temperature and quality.
- "2. Provide for the installation of fish barriers at key locations to control non-game fish.
- "3. Use of chemicals to control non-game fish.
- "4. Study of side-stream water storage development to be used exclusively for fish habitat maintenance.
- "5. Increase minimum flows of North Fork Feather River to an amount necessary for maintenance of a trout fishery.
- "6. Restock stream with strain of Feather River rainbow trout.
- "7. Evaluate the entire program by electro-sampling and angler surveys."

If physical changes required to maintain a trout fishery are determined, the state, in accordance with stipulation "C" of Article 13 of the Federal Power Commission License, could request a hearing to present findings before the Federal Power Commission. Stipulation "C" states:

"The Commission reserves the right to adjust said rates of flow in items (ii) (immediately below Rock Creek Division) and (iii) (below Cresta Dam, above, if it shall find, after notice to interested parties and opportunity to be heard, that the rates of flow are more than necessary or insufficient for such purposes."

In this case, rate of flow alone is not a controlling factor and perhaps not a dominant influencing factor.

BIBLIOGRAPHY

Personal Communications

- Daniels, Hugh R. 1975. Pacific Gas & Electric Company.
- Delisle, Glenn. 1975. California Department of Fish and Game.
- Eliason, Bruce E. 1975. California Department of Fish and Game.
- Painter, Richard. 1975. California Department of Fish and Game.
- Waters, Brian. 1975. Pacific Gas & Electric Company.

References

- California. Department of Fish and Game. 1961. Effects on fish and wildlife resources of proposed water development on the Middle Fork Feather River. Water Projects Report 2.
- . 1966. Memorandum report - James B. Richard - chemical treatment of the North Fork Feather River Rock Creek Dam to Bucks Creek Powerhouse. 4 pp.
- . 1967. Memorandum report - experimental use of Fintrol -5 for control of rogue fish. 3 pp.
- Pacific Gas & Electric Company. 1950. PG&E Progress, vol. XXVII, no. 5.
- . 1954. Information on Cresta and Rock Creek developments on Feather River project. 3 pp.
- . 1963. Proposed stream improvement on the North Fork of the Feather River in the Rock Creek section. 15 pp.
- U. S. Federal Power Commission. [n.d.] Federal Power Commission amendment no. 2 of license project no. 1962 - California. Pacific Gas & Electric Company. 3 pp.
- U. S. Fish and Wildlife Service. 1948. A report on fish and wildlife resources in relation to the water development plan for the proposed Feather River, Rock Creek and Cresta projects. 9 pp.
- . 1962. Preliminary draft initial follow-up report of Rock Creek - Cresta project FPC no. 1962, North Fork Feather River. 21 pp.
- . 1962. Supplementary follow-up report for Rock Creek - Cresta project FPC no. 1962, North Fork Feather River. 12 pp.